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February 7, 1986

THE ENGINEER

MANUFACTURING MANAGEMENT

NEW MATERIALS ARE

ALUMINUM'S 100TH:
LOOKING FOR MORE ICING
COMPUTERS LEND AN EAR

IRON AGE

MANUFACTURING MANAGEMENT



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IRON AGE (ISSN 0891-780) is published 24 times a year by CHILTON COMPANY, Clinton Way, Warminster, PA 19086. CHILTON CO. is a division of American Broadcasting Companies Inc., New York, NY. Second Class postage paid at Warminster, PA 19086 and additional mailing offices. IRON AGE is sent free of charge to all registered qualified managers in U.S. manufacturing companies. (Domestic) Manufacturing Management edition—\$50 one year, \$85 outside U.S. 12 issues. (International edition)—\$80 one year, \$55 Canada. Foreign 12 issues. Single copies, \$3.00. Copyright 1986 Chilton Publications. Second-class postage paid at Warminster, PA. Post Office Box 1490, Warminster, PA 19086.



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Looking for more icing

BY ROBERT REGAN

The birthday cake the aluminum industry cuts this month has 100 candles on it.

The icing on it has grown a bit thin in places, but the cake itself has grown tremendously, particularly in the latter decades of aluminum's first century.

Profit margins have taken quite a battering in the 1980s. But the past several years also have seen many of the producers restructuring and repositioning themselves—at great expense—to repair profitability, credit standing with the banks and financial resources for research and development programs needed to survive in today's high tech markets against stiff intramural and international competition and pressure from other materials.

The birthday party marks the 100th anniversary of the development of a viable process for commercial production of aluminum. The discoverers were Charles Martin Hall in the U.S. and Paul L. E. Heroult, working independently in France, and the result was the eleva-

tion of aluminum from laboratory curiosity to workhorse metal.

The birthday won't be without a few ironies. For one, the U.S., home of Hall's process and the first commercial producer, Aluminum Co. of America (now Pittsburgh Reduction Co.), currently is the scene of substantial shrinking of capacity to produce aluminum.

For another, Alcoa has folded the tents on a 12-year effort to develop an alternative to the Hall process. The closed cell technology used in the Alcoa Smelting Process was said to work well, but the supply system producing the aluminum chloride feed-stock was, as former Alcoa Chairman W.H. Krome George once put it, "a plumber's nightmare."

(Alcoa celebrates its centennial in 1988, but this month's shindig on Feb. 23 is one everybody in the aluminum business will be celebrating.)

The aluminum producers put a lot of time and money into boosting the efficiency of the Hall process, along with some imported technology, but the substantial improvement in energy efficiency achieved (which considerably narrowed the gap with the efficiency target of the Alcoa Smelt-

ing Process) wasn't enough to offset rising energy costs.

Although the price of oil has been retreating of late, the cartel-propelled price spiral of the 1970s did its damage and competition for low cost hydroelectric power did the rest.

Alumax, Inc., in 1980 started up what is likely to be the last greenfield smelter in the U.S. near Charleston, S.C. Since then, it's been a case of steady contraction and one recent forecast put domestic capacity by the end of 1987 below 3.7 million tons compared with the 5.6 million tons a year on the books at the start of 1985.

Alcoa is starting off the first year of aluminum's second century carrying out plans to slash domestic capacity by 350,000 tons to about 1.22 million tons a year. Reynolds Metals Co., Kaiser Aluminum & Chemical Corp., Revere Copper & Brass, Arco Metals, Conaleo and Martin Marietta Aluminum all have either pared capacity or pulled out of aluminum smelting altogether. (One of Martin Marietta Aluminum's two smelters was picked up in 1985 by Commonwealth Aluminum

U.S. ALUMINUM SHIPMENTS BY MARKETS
(In Millions of Lbs.)

	1960	%	1984	%
Building & construction	1,173	24.8	2,856	18.5
Transportation	899	19.0	2,939	19.0
Consumer durables	513	10.8	1,106	7.2
Electrical	528	11.2	1,492	9.7
Machinery & equipment	333	7.0	825	5.3
Containers & packaging	321	6.8	4,038	26.2
Exports	617	13.0	1,076	7.0
Other	348	7.4	1,094	7.1
TOTAL	4,732		15,246	

U.S. ALUMINUM TRADE
(Millions of Lbs.)

	Imports		Exports	
	Ingot	Mill Products	Ingot	Mill Products
1965*	1,850	1,020	820	425
1984	1,945	1,090	572	504
1983	1,637	618	795	446
1982	1,359	456	802	492
1981	1,421	304	688	682
1980	1,161	168	1,429	763
1979	1,142	426	401	622
1978	1,516	484	253	494
1977	1,341	165	196	517
1976	1,151	189	305	516

*IA estimates Sources: The Aluminum Association, U.S. Department of Commerce

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Corp., along with substantial fabricating capacity.

It is in the fabrication and manufacturing side of the business that most of the action will be from here on out. And that's where many of the larger companies, having conceded ground to independents, overseas smelters and the London Metal Exchange, have been placing their big money bets. Even here, they are being chased higher up the value-added tree. That's why hundreds of millions of dollars have been spent acquiring new rolling capacity and modernizing and upgrading the quality of existing rolling facilities in order to keep ahead of the overseas competition.

Can Stock

The main arena over the next several years is the market for can stock, which alone accounts for over a fifth of total U.S. aluminum industry shipments and nearly half total aluminum sheet consumption. It's already the center of a trade row with Japan. Aluminum industry analyst J. Clarence Morrison of Dean Witter Reynolds Inc. has calculated that can stock imports, mainly from Japan, Canada and Australia cap-

tured 10 pct of the domestic market last year and that Japan accounted for half of can stock imports.

Is there still room for growth or will the years ahead see the established producers preoccupied with defending turf against newcomers and other materials? Says David P. Reynolds, chairman of Reynolds Metals Co., "In addition to the many untapped and still unknown uses for aluminum that can and will emerge in the years ahead, the industry has another strong basis for anticipated growth. It is the very low per capita consumption of aluminum in most areas of the world outside the U.S. including Eastern Europe, China, Pacific Asia and South America.

"The industry will always be challenged by competing or alternative materials and there is every likelihood that in many future uses of aluminum, it will perform in combination with other materials to do specific jobs."

Mr. Reynolds said he doesn't think the shift of ingot capacity to foreign shores will have a parallel in flat rolled aluminum and other mill products. "One of the major reasons for the U.S. becoming uneconomic in the production of primary alumi-

num was high energy costs, but in some cases it also was obsolescent facilities. These are not factors in the area of sheet and mill products since our fabricating facilities require relatively insignificant amounts of energy in comparison to primary and there have been and continue to be advances in process technology and automation.

"Furthermore, the industry has invested and will invest substantial sums in modernizing its fabricating capacity to achieve higher quality, production and competitiveness. Add to this the expectation that, as per capita consumption increases abroad, there will be less pressure on foreign producers of mill products to ship to the U.S. market.

"We cannot lose sight of the fact that the aluminum industry is an international industry. Despite the current trials and tribulation of North American producers, most other aluminum companies around the world are prospering. Looked at from a global perspective, the aluminum industry is quite healthy, as indicated by the fact that in 1985 we enjoyed another record year for demand, consumption and shipments. We are very optimistic about the outlook for aluminum's second century," Mr. Reynolds said.

Kaiser Aluminum & Chemical Corp., just emerging from a \$230 million beefing up of its Trentwood, Wash., rolling mill, said the main goal of the program, which also included the Ravenswood, W.Va. mill to a lesser extent, was "to ward off the loss of sheet and plate business to offshore producers."

"In aluminum's second century," said Kaiser Chairman Cornell C. Maier, "there will be penetration and growth in markets served by other materials. However, because of inroads already made by aluminum, the growth rate will be considerably slower. The niches that will be carved out by aluminum will be more of the exotic type. In an effort to capture some of these markets, research will concentrate to some extent on advanced materials such as aluminum-lithium alloys, primarily for aircraft, aerospace and defense applications; aluminum-lithium

One of the aluminum industry's hopes for its next century is further growth in automotive uses like this all-aluminum driveshaft being installed in a Ford Aerostar mini-van.



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powder metallurgy for extrusions and forgings, and metal matrix composites. There will be more and more material combinations, like aluminum and plastic, ceramics and aluminum, and ceramic, plastic and aluminum."

Kaiser Aluminum, which was compelled to grapple with a take-over attempt as it was emerging from its multi-million-dollar modernization program, "is closing in on the goal set for cost reduction in raw material, primary metal and fabricating parts of the business. In addition, we have reduced costs and increased competitiveness through renegotiation of our contract with the United Steel Workers," Mr. Maier said.

On the final day of 1985, Kaiser Aluminum announced it was writing down the value of its Baton Rouge, La., alumina refinery and several smaller assets by \$160 million after taxes and will reduce the company's net worth by that amount. The Baton Rouge facility has been idle since 1983.

Alcan Aluminium, Ltd., a short time later announced it would report a \$215 million write-down for the fourth quarter of 1985, most of which reflects reduction of the value of bauxite and alumina operations. The company didn't specify which properties were affected. Alcan has bauxite and alumina facilities in Jamaica, alumina refineries in Ireland and Canada, and participates in bauxite and alumina ventures in Spain, Australia and Brazil.

Alcoa's planned 350,000 tons a year cutback in smelter capacity is part of a \$175 million fourth quarter writedown that also includes alumina capacity and investment in the Palestine, Tex., plant where the Alcoa Smelting Process was being tested. Alcoa Chairman Charles W. Parry said the company "is restructuring its primary aluminum business to reflect fundamental changes in the structure of the world aluminum industry." He said the move was "part of the company's stated strategy of bringing its consolidated refining and smelting system nearly into balance with the metal needs of our U.S. fabricating system."

"We expect this action to improve the company's cost structure and complement our objective of using advanced technology and higher levels of quality to gain advantage in those parts of the aluminum business that offer the greatest financial rewards."

Alcoa's heavy investments over the past several years have been concentrated on modernization of rolling mills in Alcoa, Tenn., Warrick, Ind., and Davenport, Iowa, and have stressed competitiveness in can stock in particular.

A. Stephen Hutchcraft, Kaiser Aluminum's president and chief operating officer, said the modernization program at Trentwood boosted rolling capacity by 25 pct while cutting conversion costs by about a third. The program, he said, "is Kaiser's ticket to the 21st Century."

Centerpieces in the revitalized 40-year-old plant include two electromagnetic casters and an 80-in. hot mill said to be the only six-high unit in operation anywhere in the aluminum business. One advantage is the extra intermediate rolls to control roll deflection and provide maximum flatness and crown control. Mr. Hutchcraft estimated that the electromagnetic casting units saved the company \$10 million in scalping equipment required with conventional casting methods.

Kaiser has two electromagnetic casters operating at Trentwood, a third "in the oven" and a fourth in the planning stage. Next stop? "Electromagnetic casting for the Ravenswood, W. Va. rolling mill—as soon as we can afford it," a Kaiser official said.

Trentwood now is capable of producing about 450 million lbs of flat rolled products a year, a gain of about 13 pct. The mill's reach can be extended another 100 million lbs with the installation of more equipment.

As aluminum starts its second century, Commonwealth Aluminum Corp. is embarking on its second year and sees the aluminum market becoming more selective and more specialized.

"The industry will become more market-driven and market selection

will influence plant configuration," said William T. Sullenberger, vice president, marketing and sales. He also said aluminum mills will become specialty mills focusing on markets and products where they feel they can get the best return and "the supplier of all products to all markets will disappear."

Mr. Sullenberger said the "aluminum market made available by the London Metal Exchange has reduced the need for fully integrated complexes. The second century will see partially-integrated producers and fabricators as more the norm."

Even though fundamental change taking place throughout the industry is causing problems for the producers currently, "we believe it is moving in the right direction for consumers because it is moving to lower cost and higher quality aluminum products. And the U.S. sheet producers have consolidated their position as the technological leaders," he said.

The shakeout in the primary sector, while painful to some companies, eventually will prove beneficial as it lowers the cost of the basic material to integrated and independent fabricators alike. The economies, Mr. Sullenberger continued, derive in part from writing off high cost plants in favor of low cost plants. As ingot weighs only a quarter of the bauxite required to produce it (and half the weight of the alumina in cases where that was the raw material transported to the smelter) ingot cost is lower when the smelter is near the raw material source, assuming there is economical energy available as well. Another advantage, Mr. Sullenberger said, is lower labor costs.

More Recycling

The integrated producers, meanwhile, are increasing their recycling operations, thereby reducing both raw material costs and dependence on external sources of primary metal. As for the rolling mills of the future, the Commonwealth Aluminum official said, these will remain situated close to consumers to capitalize on such advantages as shorter lead times and lower inventory require-

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ments. They will be increasingly higher technology, computer controlled plants that will be less labor intensive and able to produce higher quality products.

Alcan Aluminum Corp., U.S. arm of Montreal-based Alcan Aluminum, increased its U.S. position in 1985 by purchasing smelting and fabricating facilities from Arco Aluminum—plus a 40 pct interest in the big Logan County, Ky., rolling mill that will be pressing hard for can stock business this year.

The emphasis on aluminum's biggest single market notwithstanding, the Cleveland-based company's goal for 1990 "is 25 pct of total sales from products or businesses that we are not in today," according to Timothy C. Tuff, who took over Roy Gentles' spot as president in a recent reorganization.

"We see no shortage of opportunities, although most are specialty, high value-added global markets calling for high levels of technical competence," he said.

Mr. Tuff identified aluminum-lithium alloys as an area of particular interest (and one in which Alcan will be bumping noses with Alcoa, Reynolds, Kaiser and other companies including Aluminium Pechiney of France).

"We believe this material will become the major structural material for the next generation of aircraft," he said, adding that while Alcan will be supplying prototype material from its United Kingdom facilities initially, "U.S.-produced material will be available when the volume of demand starts building."

In a recent aluminum survey, the *London Economist* said the significance of aluminum-lithium alloy "is great as a defensive strategy against new carbon fiber products, but it does not seem to be a route toward extra tonnage—unless the product can be price-competitive in many more general applications."

Mr. Parry, Alcoa's chairman, recently observed that aluminum has lost market ground to plastics in the form of graphite fibers and composites over the past five years. "Aluminum-lithium will stem that to some degree and will stop the encroach-

ment of composites into the aerospace market. But Alcoa is also working on composites where there are advantages to using composites, particularly in military applications," he said.

Alcan Aluminum's Mr. Tuff said another opportunity being created for aluminum by the changing market environment—in this case deregulation of rail freight rates—is the drive to offer more efficient rail cars, particularly for hauling coal.

In a joint venture called Tarco (The Aluminum Railcar Co.), Alcan Aluminum and Thrall Car Manufacturing Co. recently completed construction of a prototype rotary dump rail car said to be able to haul 110 tons of coal, 10 pct more than conventional designs can carry.

Alcoa last September calculated that 43 pct of coal cars ordered in the U.S. since 1983 were aluminum. This estimate followed an order by Georgia Power Co. for 600 aluminum coal cars from Ortner Freight Car Co. of Milford, Ohio.

Mr. Tuff said Alcan soon will open a plant at Riverside, Calif., for production of superplastic aluminum alloy composite sheet for use in complex aerospace parts and automotive panels and accessories.

As far as Aluminum Pechiney is concerned, "aluminum always has a future ahead of it. This future is packaging (which will be developed in Europe), it is laminated tubes, it is aluminum-lithium, it is aluminum matrix composites."

And, while primary aluminum capacity may be shrinking in the U.S. where "the management and location strategies for different types of electric power plants have made energy costs quite expensive in areas with a high concentration of reduction facilities, this situation should not be confused with the rest of the world," said G.Y. Kervern, president of the Pechiney Group's aluminum unit.

"France, in particular, benefits from a much more favorable situation in view of the major developments in nuclear energy," he added.

Mr. Kervern also said that the Hall-Heroult Process is being used more than ever and continually im-

proved with new technology, including the 180,000 ampere cell technology developed by Pechiney.

The integrated French producer expects to have its joint venture 230,000 tons a year smelter in Becancour, Que., started up this May. Its partners in the venture, Almax and the Quebec government, each hold 24.95 pct shares and Pechiney holds 50.1 pct. Becancour uses Pechiney's 180,000-amp cell technology, which the company notes has accounted for one out of every two tons of new capacity brought onstream worldwide since 1980.

Pechiney also is increasing capacity at its St. Jean de Maurienne smelter from 50,000 to 120,000 tons a year with two new potlines employing its 280,000-amp pots.

Start-up of a \$40 million aluminum-lithium plant able to produce up to 4,000 tons of slab and billet a year is scheduled for late 1987.

Overseas trade was very much in the mind of Joseph D. Crider, executive vice president of Reliance Steel & Aluminum Co., when he warned at a late 1985 meeting of the National Association of Aluminum Distributors that American industry has been on the defensive to long.

"If our customers in the automotive, machinery, transportation and high tech industries can't compete in the world market, then our customer base is slowly going to shrink and our low cost, subsidized friends overseas will turn us from a front rank industrial economy into a service economy," he said.

The NAAD, of which Mr. Crider is current president, is looking for positive impact on aluminum distributor business this year from growth in the money supply, some reduction in the trade deficit and further devaluing of the dollar. Aluminum distributors account for about 31 pct of industry shipments to markets served by producers and distributors. Commonwealth Aluminum's Mr. Sullenberger has predicted a trend away from mill owned distribution, a trend toward smaller regional chains, more specialization and continuation of open distribution. □

COMPUTERS LEND AN EAR

When using a computer in the factory, the entry of data via a keyboard can be slow and awkward. New technologies permit users to bypass the keyboard and speak directly to the computer.

BY ROBERT E. HARVEY

Too often computer installation is accompanied by fear and trembling.

No matter how technically sophisticated computers become, computer-integrated manufacturing (CIM) will remain an unfulfilled promise until computers become tools that the casual user, not just the computer expert, can feel comfortable with.

The integration problems between workers and computers will eventually be solved. Expert systems, natural language technology, machine vision, and other developments are already narrowing the gap between man and machine.

But as long as keyboards stand between people and computers, their partnership remains at arm's length. Developments like touchscreens, the mouse, and light pens are helping to narrow the distance. However, the merger will be complete only when people and computers are able to speak together.

And such a time is not far off. Already computers that speak and listen to operators are finding their way into quality control, production and inventory control.

Voice technology includes voice synthesis (computer speech) and speech recognition. Computers that talk are commonplace (we hear them on phones, in cars), but ones that recognize speech are still a rare breed. However, it is the recent developments in speech recognition that are sparking industry's interest in the technology.

Speech recognition was an \$11 million industry in 1984 and a \$16

million industry in 1985. The figures could reach \$22 million this year and top \$65 million in 1989, according to International Data Corp., Framingham, Mass. By 1989 more than 400,000 speech recognition products are expected to be sold, with a high percentage of sales addressing shop floor needs.

Impressed by the potential of voice technology, firms like Intel and Westinghouse recently have jumped into voice recognition markets with new products.

"Today, we are seeing increasing movement toward real-time factory floor data collection and feedback," said Alan Mandel, general manager, Westinghouse Voice Systems, Pittsburgh. "For several years now, we have thought speech recognition technology, generally, has been good enough to use in the factory. We have had work on improving its capabilities in noisy environments, but basically, the limiting factor has not been the technology but an absence of complete systems or easy-to-use application tools."

With the development of these application tools, Mr. Mandel believes voice technology is now within the reach of any manufacturer with a strong need for real-time or simply accurate information.

Tasks Made Simpler

Computers that talk and listen can make a wide variety of factory floor tasks simpler. Certain jobs—particularly those in inspection and inventory control—offer natural applications for voice technology. Often in these areas, a worker's hands



At Westinghouse's Transformer Division, an operator using voice input enters transformer style numbers into a computer.



The Westinghouse Semiconductor Division installed a voice data collection system on its semiconductor fusion test line.



At the Westinghouse Industry Electronics Division, voice entry eliminated the hand recording of final inspection results.

Shipments

	In Units	Millions of Dollars	Installed Base In Units
1984	6,300	11.3	10,200
1985	11,400	15.9	21,400
1986	20,600	21.7	42,100
1987	35,600	28.3	77,700
1988	78,400	45.6	155,900
1989	253,000	65.8	408,900

Source: International Data Corp. Framingham, Mass.

U.S. Speech Recognition Systems Market



are busy and his eyes preoccupied. If hands and eyes are needed for other tasks, data input through voice is the obvious solution.

For example, if an inspector has to inspect an airplane and record his findings at the same time, not only does his efficiency go down, the odds of him copying the data incorrectly or interpreting that copy incorrectly later on are high.

So the inspector purchases a headset (with microphone input and audio output), a speech synthesizer and a voice recognition system. With his hands and eyes now free to inspect, he can collect data more efficiently and accurately. In addition, his voice system automatically enters his data into a data base, making it immediately available for analysis and control.

The inspector finds that his job consists of responding to a series of computer-initiated audio prompts. The prompts tell him how to proceed with his inspection. After he responds to the prompts, his statement is repeated by the computer, enabling him to confirm that what he spoke was what the computer heard.

Speech technology is also popular with inventory managers who use it to sort parts, weigh assemblies, and double check orders.

Evidence points to a growing interest in voice technology: A rash of new products are coming on stream; users are vouching for the effectiveness of the technology; and systems are dropping in price.

Not everyone, however, is convinced that 1986 will be the year voice recognition at last fulfills the promise predicted for it years ago.

Doubters are saying that although the technology seems promising, voice recognition has been a perennially promising technology. It has also been a technology that often has failed to live up to its promise.

"The problem is that many early proponents in the voice industry were tremendous showmen-entrepreneurs. And they promised a lot more than their technology could deliver, so the people who bought the technology had unrealistically high expectations," explained Bruce Ryon, manager of marketing communications, Votan Corp., Fremont, Calif. "Some of these unrealistic expectations still exist, therefore we spend a lot of our time explaining realistically what the technology can and cannot do."

Unrealistic Expectations

What the technology cannot do is complex office-related tasks, but these are precisely what many people expect it to do.

"Many businessmen expect the products to perform like dictation machines. They are looking for voice-activated typewriters, or voice-activated word processors, and that technology just isn't here and won't be here for a number of years," explained Mr. Ryon.

However, just because voice technology is not yet ripe for the type-

writer does not mean that it cannot work on the manufacturing floor. A typewriter capable of processing conversation would need a vocabulary of tens of thousands of words. And it would need to know how words are used—to decide, for example, whether 'here' or 'hear' should be typed. In short, it would have to make intelligent decisions that are beyond the scope of current artificial intelligence technology.

"Limited speech recognition has been achieved," said an IBM spokesman. "But, these achievements fall far short of unrestricted continuous speech recognition."

What has been achieved, however, is not trivial. These "limited" developments dovetail nicely with the data collection needs of the factory, since voice recognition systems in the plant don't have to understand a large number of words; most factory applications require vocabularies of 150 words. Nor need they be overly concerned about context.

"On the factory floor we are looking at applications needing hundreds of words, not thousands," emphasized Mr. Mandel of Westinghouse. "Each application uses a constrained set of words. The system takes an operator through a structured inspection sequence or a structured inventory control sequence where large vocabularies just aren't needed."

"What is needed on the factory floor are smaller vocabularies, high accuracy, the capability to operate in



Planners at Lockheed-Georgia Co. speak into a microphone and enter data into a computer that produces detailed manufacturing plans.

high noise and variable noise, and the ability to operate in a mobile situation, where an operator can operate over a wireless radio link. Also, I believe strongly that continuous speech recognition is also needed. If you are going to enter a part number, you need to be able to enter it rapidly, without having to pause between digits."

Factory Floor Needs

Westinghouse has worked with voice technology for five years, internally applying it to a variety of factory applications.

"Early on we discovered that there was a need for the industrial engineer out on the floor to be able to make changes in the system over the life of the system," explained Mr. Mandel. "So we spent a great deal of effort developing some advanced menu-driven tools to let a user who isn't a programmer or a speech technology expert use the

system."

Like several of the major companies that are moving into voice technology, Westinghouse didn't develop the basic voice technology—the computer algorithms needed to capture the vagaries of human speech. Westinghouse began with basic Votan technology and added software and system layers on top of it. "What we bring to the party is the system integration and the software tools," said Mr. Mandel. "Our strength is our knowledge of manufacturing operations."

The strength of Votan—the most successful supplier of voice recognition products, with some 30 pct to 40 pct of the U.S. market—is its basic voice expertise. Its product line includes: a circuit card and software that add voice recognition and voice output capabilities to the IBM PC; a voice terminal that gives these abilities to micro- and minicomputers; and a multichannel voice processing/telephone management system.

Like Westinghouse, Intel recently introduced a new speech recognition product line aimed principally at factory applications.

"Although speech recognition has been successful in many applications, the harsh environment of factories—dirt, dust, vibration and high ambient noise levels—has prevented its use in industrial automation," said Dan Fink, marketing manager of Intel's Speech Systems, Phoenix. To overcome these limitations, Intel is using non-volatile bubble memory to combat dirt and vibration problems and a noise-canceling speech recognition algorithm to gain noise immunity.

Major Players

Other major players in the voice recognition market include Interstate, Texas Instruments, and NEC, to name but a few. They reportedly are directing much of their efforts at the office systems. Interstate, however, recently purchased the technology of Verbex, a division of Exxon Enterprises and a maker of speech recognition devices, and consequently could become more active in the factory market.

A recent announcement by IBM of a speech board that will fit into an IBM PC is significant, not because it targets the factory, but because it helps legitimize voice recognition.

Voice recognition systems come in a variety of shapes and sizes. Some products, for example, demand that users pause between each spoken word. Continuous speech systems, on the other hand, permit a user to enter commands and data using normal speech.

Also, current systems are either speaker dependent and speaker independent. A speaker-dependent product recognizes voice patterns of only one user. The user has to "train" the system before use. During training he must enter a vocabulary of specific words which the system will subsequently recognize. The computer must be retrained if the vocabulary is altered or someone new uses the machine.

A speaker-independent system can recognize words entered by any speaker. At present, speaker-independent systems have limited vocabularies—possibly 15 words.

Currently, voice technology is most prevalent in inspection and inventory control operations. However, other uses are evolving. For example, it is being incorporated into CAD/CAM systems, permitting operators to execute design functions both manually or verbally.

Also, Lockheed-Georgia Co., Marietta, Ga., is incorporating voice input technology into its computer-based generative process planning system, GENPLAN. The system will detail step-by-step plans for fabricating and assembling parts.

"When planners are at a terminal, they often have their hands full with engineering drawings, manuals, and other documents," said a company spokesman. "Putting drawings down or turning away from the manuals to enter data takes time and breaks their concentration. That break in concentration costs time and can lead to errors."

Currently, the system allows the user to verbally input process plan information. In the future he will be able to edit his process plan on

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the computer screen using voice.

The voice data entry system, based on an IBM PC AT, consists of a terminal emulation package called IRMA, a voice recognition board from Tecmar, and software developed by Lockheed. It is a user-dependent, discrete-word system.

Lockheed researchers got involved with voice technology because they saw a rapidly changing technology that had the potential to greatly improve productivity. "We are doing a lot of testing of different voice boards and we are writing some of our own software in an effort just to keep up with the technology," explained Luther Hudson, manager of Lockheed-Georgia's Computer-Aided Systems Department. "Recently circuit boards have been getting better and better. Continuous word recognition, however, is one area we feel still needs a little more development, at least in the manufacturing environment."

In the future, voice systems will become even more versatile. Certain industrial applications require extra large vocabularies, so tomorrow's systems will have larger vocabularies. Present systems can handle up to 500 or 600 words.

As vocabulary needs grow, Mr. Mandel expects the the voice technologies aimed at the office and those targeting the factory will begin to merge. At present IBM has an experimental system which allows voice input to create office documents such as letters and memos. It can recognize sentences computed from a 5,000 word vocabulary and identifies more than 95 pct of the words in these sentences correctly. In the future, this type of technology will find its way to the factory floor. Eventually, workers will be able to hold unstructured conversations with their computers.

However, Mr. Ryon of Votan believes that while voice systems will improve over time, the technology that is available today can handle many industrial tasks.

"Growth of voice technology depends not so much on new technology but on how quickly companies become aware of current applications," he explained. □

PRICE & PRODUCTION DATA

(Effective January 13, 1986)

Steel production by districts, thousands of tons
(000 omitted)

	Last Week	Two Weeks Ago	Month Ago	Year Ago
Northeast Coast	181	157	166	162
Pittsburgh	219	194	222	191
Youngstown	101	85	97	88
Lake Erie	122	118	123	140
Detroit	128	120	134	139
Chicago	487	467	386	410
Cincinnati	86	77	82	83
St. Louis	73	79	77	76
Southern	200	196	199	171
Western	83	75	71	71
U.S. Production	1,700	1,563	1,557	1,531

Source: American Iron & Steel Institute

Lake Superior Ore Prices

51.4% Fe hematite delivered prices, plus 10% transportation charges (5% maximum) for loading and unloading may be 10% discount. Tonnage in thousands.

Pellets (per iron unit natural)	gross ton \$58.00
Pellets (per iron unit natural)	gross ton \$59.00
Pellets (per iron unit natural)	gross ton \$72.50-91.00
Mesabi, regular-unsheathed	gross ton \$32.50
Mesabi, non-bessemer	gross ton \$30.00-31.50

*All prices are FOB Lake Superior ports, plus 10% transportation charges (5% maximum) for loading and unloading may be 10% discount. Tonnage in thousands.

STEEL PRODUCTION, COMPOSITE PRICES

(Effective January 13, 1986)

U.S. Steel Production

	Last Week	Two Weeks Ago	To Date 1986	To Date 1985
Net tons, in thousands	1,700	1,563	2,592	2,306
Capacity Utilization Rate	68.1	61.4	66.1	56.7

Composite Prices

	This Week	Week Ago	Month Ago	Year Ago
Finished Steel Base*				
(c. 10—c. 11, 1 1/2)	24.607	24.607	27.582	27.582
Pig Iron** (Net ton—				
2000 lbs.)	\$213.00	\$213.00	\$213.00	\$213.00
Scrap No. 1 hvy.***				
(Gross ton—2240 lbs.)	\$73.17	\$73.17	\$70.17	\$80.50
No. 2 bundles	\$52.83	\$52.83	\$50.50	\$52.83

Scrap Comparison (Gross Ton)

No. 1 steel, Pittsburgh	\$73.50	\$73.50	\$71.50	\$83.50
No. 1 steel, Philadelphia	71.50	71.50	69.50	77.50
No. 1 steel, Chicago	74.50	74.50	69.50	80.50
No. 1 bundles, Detroit	70.50	70.50	64.50	70.50
Low Phos. Youngstown	73.50	73.50	69.50	72.50
No. 1 mach'y cast, Phila.	68.50	68.50	68.50	66.50
No. 1 mach'y cast, Phila.	92.50	91.50	91.50	98.50
No. 1 mach'y cast, Chi.	104.50	104.50	97.50	111.50

*All prices are FOB Lake Superior ports, plus 10% transportation charges (5% maximum) for loading and unloading may be 10% discount. Tonnage in thousands.

**All prices are FOB Lake Superior ports, plus 10% transportation charges (5% maximum) for loading and unloading may be 10% discount. Tonnage in thousands.

***All prices are FOB Lake Superior ports, plus 10% transportation charges (5% maximum) for loading and unloading may be 10% discount. Tonnage in thousands.

NONFERROUS PRICES

Effective January 13, 1986. All prices are FOB Lake Superior ports, plus 10% transportation charges (5% maximum) for loading and unloading may be 10% discount. Tonnage in thousands.

Primary Metal Prices

	Current Price	1985 Price	1984 Price
Aluminum (IME)	50.79	50.79	1.18.85
Copper (C)	68.50	68.50	1.18.85
Lead	18.50	18.50	1.18.85
Magnesium	19.50	19.50	1.18.85
Nickel (IME)	153.00	153.00	1.18.85
Zinc	35.00	35.00	1.18.85

*All prices are FOB Lake Superior ports, plus 10% transportation charges (5% maximum) for loading and unloading may be 10% discount. Tonnage in thousands.

Antimony, American Landed, Texas	\$2.00
Beryllium-aluminum 5% Be	
per lb. contained Be	\$236.00
Beryllium-copper, per lb. contained Be	\$344.00
Beryllium 97% powder 200	\$197.00
Cadmium, non-iso	\$125.00
Chromium, 99.5% electro	\$3.92
Cobalt, 99% cathode	\$11.70
Gold, per tray oz	\$239.40
Indium, dollars per tray oz	\$2.50
Indium, dollars per tray oz	\$430.00
Magnesium sticks, 10,000 lbs.	\$2.00
Mercury, per 76-lb. c. b. N.Y.	\$320.00-330.00
Molybdenum, lb. tech. moly.	
oxides, 20 lb. MO can	\$3.00-3.13
Palladium, per tray oz	\$100.00

Rhodium, per tray oz	\$558.00
Rhenium, per tray oz	\$1,125.00
Silver, ingots, per tray oz	\$6.03
Titanium sponge, high grade	\$340.35
Tungsten powder, high grade	\$930.50
Vanadium	\$6.00
Zirconium, high grade	\$12.00-17.00

Straits Tin Price

All prices are FOB Lake Superior ports, plus 10% transportation charges (5% maximum) for loading and unloading may be 10% discount. Tonnage in thousands.

tin 5% TRADING	Jan 9
tin 5% SUSPENDED	Jan 10
tin 5%—	Jan 10

**Scrap Prices
Brass Mill Scrap**

All prices are FOB Lake Superior ports, plus 10% transportation charges (5% maximum) for loading and unloading may be 10% discount. Tonnage in thousands.

	Solids	Turnings
Copper	51	52
Yellow brass	51 1/2	45 1/2
Red brass	55	48 1/2
Copper-bronze	57 1/2	49 1/2
Ming, bronze	43	42
Free cutting rod ends	46	46

Custom Smelters Scrap

All prices are FOB Lake Superior ports, plus 10% transportation charges (5% maximum) for loading and unloading may be 10% discount. Tonnage in thousands.

No. 1 copper wire	58
No. 2 copper wire	51
Light copper	42

Ingot Makers Scrap

All prices are FOB Lake Superior ports, plus 10% transportation charges (5% maximum) for loading and unloading may be 10% discount. Tonnage in thousands.

No. 1 copper wire	54
No. 2 copper wire	47
Light copper	38
No. 1 composition	47
No. 1 comp. turnings	46
Hvy. yellow brass solids	29
Hvy. yellow brass turnings	26
Radiators	36

Aluminum		
New mixed chips	35	36
Old sheet	32	33
Old cast	32	33
Clean dry borings	33	34

Dealers' Scrap

All prices are FOB Lake Superior ports, plus 10% transportation charges (5% maximum) for loading and unloading may be 10% discount. Tonnage in thousands.

Aluminum

Segregated loadings	25	26
Mixed & C. chips	22	23
Old sheets and cast	20	21
Borings and turnings	16	18
Duraluminum clippings	24	25

Copper and Brass

No. 1 copper wire	45	46
No. 2 copper wire	37	39
Light copper	32	33
Radiators	30	31
No. 1 composition	39	40
No. 1 composition turnings	36	37
Clocks and faucets	28	29
Clean heavy yellow brass	27	28
Brass Pipe	28	29
New soft brass clippings	39	40

Lead

Heavy soft lead	5	7
Whole batteries	1	3
Type metal	15	17
Electrotype	13	14

Nickel

Nickel solids	110	120
Nickel rod ends	110	120
Nickel sheets, clips	110	120
Nickel turnings	25	35

Zinc

New zinc clippings	15	16
Old decastr zinc	11	13

For additional information, contact Michael Marley, Managing Editor, Iron Age, Chilton Co., Chilton Way, Radnor, Pa. 19089.

STEEL PRICES

PRODUCER KEY

With Principal Offices

A7 Armco Inc., Middletown, Ohio
A8 Atlantic Steel Co., Atlanta, Ga.
A11 Atlantic Wire Co., Brantford, Conn.

B1 Barco Drawn Steel Corp., Towaco, N.J.
B3 Bethlehem Steel Corp., Bethlehem, Pa.
B4 Blair Strip Steel Co., New Castle, Pa.
B5 Bliss & Laughlin Steel Co., Harvey, Ill.

C6 C&I Steel Corp., Piquette, Conn.
C10 Clappan Steel Co., Wilmet, Ohio
C16 Columbia Steel Co., Birmingham, Ala.
C20 Colson Steel Div., Chicago Heights, Ill.

D1 Detroit Strip Div., Evident Corp.

E4 East Bridge Steel Co., New Castle, Pa.

F1 Erie Steeling, Inc., McKeesport, Pa.

G2 Granite City Steel Div., National Steel Corp., Granite City, Ill.
G3 Great Lakes Steel Div., National Steel Corp., Ecorse, Mich.
G4 Greer Steel Co., Dover, Ohio
G5 Green River Steel Corp., Owensboro, Ky.
G6 Gibraltar Steel Corp., Buffalo, N.Y.
G7 Georgetown Steel Corp., Georgetown, S.C.

H1 Hercules Drawn Steel Corp., Elyria, Mich.

I2 Ingersoll Steel Div., Newburgh, Ind.
I3 Inland Steel Co., Chicago
I4 Interlake Steel Corp., Chicago

J2 Jessco Steel Corp., Washington, Pa.
J3 Jones & Laughlin Steel Corp., Pittsburgh
J4 Joslyn Mfg. & Supply Co., Chicago
J5 Judson Steel Corp., Easleyville, Calif.

K2 Keystone Consolidated Industries, Inc.
K3 Kentucky Electric Steel Co., Ashland, Ky.
K5 Kemco Div., Route Mineral Co., Keokuk, Ia.

L2 La Salle Steel Co., Chicago
L3 Lone Star Steel Co., Dallas
L4 Lukens, Inc., Coatesville, Pa.

M2 McLouth Steel Products Corp., Detroit
M8 Mill Strip Products Div., National Steel Service Center, National Steel Corp.
M9 Malheur Steel Products Co., Beaver Falls, Pa.
M11 Midwest Steel Div., National Steel Corp., Portage, Ind.

N1 Northeast Precision Steel Co., Boston

N4 Northwestern Steel & Wire Co., Sterling, Ill.
N6 Northwest Steel Rolling Mills, Seattle
N9 Nelson Steel & Wire Co., Chicago
N10 North Star Steel Co., Saint Paul, Minn.

O2 Oregon Steel Mills, Portland, Ore.

P2 Phoenix Steel Corp., Claymont, Del.
P15 Philadelphia Steel and Wire Corp., Phila.

P3 Republic Steel Corp., Cleveland
R4 Ramo Steel Co., Buffalo, N.Y.
R5 Rabbin Steel Corp., North Tonawanda, N.Y.
R8 Rymer Strip Steel Co., Roma, N.Y.

S1 Sharon Steel Corp., Sharon, Pa.
S2 Stanley Works, New Britain, Conn.
S8 Superior Drawn Steel Co., Monaca, Pa.
S10 Svecia Steel Corp., Buffalo, N.Y.

S16 Southern Precision Steel Co., Gulfport, Miss.

T4 Thomas Steel Strip Co., Warren, Ohio
T5 Timken Co., Steel Division, Canton, Ohio
T7 Texas Steel Co., Fort Worth, Tex.
T9 Triumph Electric Corp., Chicago
T10 Tennessee Forging Steel Corp., Harriman, Tenn.
T11 Teledyne Columbia-Sumner, Inc., Carnegie, Pa.

U1 United States Steel Corp., Pittsburgh
W3 Weirton Steel Corp., Weirton, W. Va.
W5 Wheeling-Pittsburgh Steel Corp.
W7 Wilson Steel & Wire Co., Chicago
W10 Wycroft Steel Div., Ampco-Pittsburgh Corp., Pittsburgh
W14 Whittier Steel Strip Div., Whittier Industries, Ltd., Detroit

STEEL SERVICE CENTER PRICES

Price, Dollars per 100 lb

Prices are based on the following conditions: All prices are for standard weight, unless otherwise specified. Prices are for standard weight, unless otherwise specified. Prices are for standard weight, unless otherwise specified. Prices are for standard weight, unless otherwise specified.

	Product	Sheets		Strip		Plates		Shapes		Bars		Alloy Bars			
		Hot Rolled	Cold Rolled	Hot Rolled	Cold Rolled	Hot Rolled	Cold Rolled	Hot Rolled	Cold Rolled	Hot Rolled	Cold Rolled	Hot Rolled	Cold Rolled	Hot Rolled	Cold Rolled
G2	Granite City Steel Div., National Steel Corp., Granite City, Ill.	24.16	30.15	33.60	26.66	24.66	23.22	21.05	26.73	35.62	44.85	57.90	66.57		
G3	Great Lakes Steel Div., National Steel Corp., Ecorse, Mich.	24.11	28.97	34.02	31.14	30.35	28.49	23.78	33.08	46.54	50.79	57.10	65.47		
G4	Greer Steel Co., Dover, Ohio	22.79	27.62	32.60	26.44	23.68	23.33	22.35	29.13	43.72	49.65	58.62	66.75		
G5	Green River Steel Corp., Owensboro, Ky.	30.96	37.08	43.72	41.54	31.23	29.70	25.01	32.57	38.73	40.46	49.57	54.66		
G6	Gibraltar Steel Corp., Buffalo, N.Y.	27.96	33.52	39.73	34.24	28.37	25.84	21.26	30.07	37.80	38.46	44.68	52.51		
G7	Georgetown Steel Corp., Georgetown, S.C.	25.81	32.81	36.03	24.23	21.92	20.59	19.30	24.99	29.30	36.30	44.26	48.92		
H1	Hercules Drawn Steel Corp., Elyria, Mich.	26.69	32.94	35.92	24.96	24.66	19.88	18.68	26.34	31.24	37.41	42.52	48.90		
I2	Ingersoll Steel Div., Newburgh, Ind.	25.57	32.17	35.64	27.60	24.19	22.15	19.05	26.25	34.10	37.45	42.76	50.25		
I3	Inland Steel Co., Chicago	26.26	35.17	34.44	31.39	26.36	24.20	21.49	34.15	44.04	51.41	57.29	63.86		
I4	Interlake Steel Corp., Chicago	26.43	33.16	35.33	24.16	24.66	20.50	19.06	26.32	31.14	37.08	42.57	49.48		
J2	Jessco Steel Corp., Washington, Pa.	24.82	27.06	30.33	33.41	24.72	24.31	22.05	36.65	42.12	41.99	53.65	60.00		
J3	Jones & Laughlin Steel Corp., Pittsburgh	27.62	34.67	36.90	26.66	25.35	21.25	18.40	30.97	36.41	39.84	44.87	50.82		
J4	Joslyn Mfg. & Supply Co., Chicago	24.59	29.20	30.08	30.99	31.93	32.90	33.00	34.91	35.97	37.06	38.18	65.41		
J5	Judson Steel Corp., Easleyville, Calif.	21.78	30.60	31.64	26.90	24.43	24.15	21.65	30.50	33.71	44.20	54.48	63.87		
K2	Keystone Consolidated Industries, Inc.	26.03	32.57	35.82	26.25	24.99	21.28	19.27	25.16	32.23	36.77	41.78	48.91		
K3	Kentucky Electric Steel Co., Ashland, Ky.	29.19	36.09	40.14	36.38	30.67	25.04	22.47	33.05	36.74	41.43	44.90	51.13		
K5	Kemco Div., Route Mineral Co., Keokuk, Ia.	25.17	32.64	38.45	38.00	27.96	26.10	22.25	29.00	37.35	42.07	49.95	56.28		
L2	La Salle Steel Co., Chicago	34.95	38.19	42.78	34.22	33.37	27.78	25.62	27.40	35.31	39.15	44.84	50.07		
L3	Lone Star Steel Co., Dallas	25.98	29.47	36.46	31.41	32.56	34.45	27.54	37.58	46.18	51.65	63.57	—		
L4	Lukens, Inc., Coatesville, Pa.	24.49	29.71	30.61	31.53	32.49	33.47	34.00	35.52	36.59	37.70	38.84	63.41		
M2	McLouth Steel Products Corp., Detroit	27.78	28.19	29.04	29.92	30.32	31.75	32.00	33.70	34.72	35.17	36.85	65.16		
M8	Mill Strip Products Div., National Steel Service Center, National Steel Corp.	20.41	28.65	28.65	32.28	32.02	33.63	23.45	36.94	39.45	42.17	—	54.16		
M9	Malheur Steel Products Co., Beaver Falls, Pa.	26.11	29.84	29.84	26.73	23.57	19.95	19.63	29.16	34.95	38.09	43.11	49.76		
M11	Midwest Steel Div., National Steel Corp., Portage, Ind.	25.90	31.58	31.58	30.83	23.67	26.52	19.13	28.60	34.40	37.29	42.36	49.30		
N1	Northeast Precision Steel Co., Boston	Prices at all points include transportation delivery charges.													

Codes identify Producers listed on p. 64. (Prices quoted are mill base prices in cents per pound unless otherwise noted and do not reflect extras or surcharges.)
N.A. = Not available

Billets, Blooms, Slabs

(Dollars per net ton)

Carbon Rerolling

Midwest	
W5	\$366.00
N4	\$366.00
West	
C6	\$346.00
Carbon Forging	
East	
B3/2	\$473.00
C10	\$473.00
Midwest	
W5	\$453.00
S1	\$473.00
I3	\$473.00
C10	\$473.00
K2	\$473.00
West	
C6	\$420.00
Alloy	
East	
B3	\$512.00
C10	\$512.00
Midwest	
W5	\$492.00
I3	\$512.00
C10	\$512.00
S1	\$512.00
West	
C6	\$469.00

Structurals

Carbon	
B3	23.90
J3	23.90
Midwest	
C20	22.90
W8	22.90
I3	23.90
T10	23.90
N4	23.90
South	
T10	22.90
High Strength Low Alloy	
East	
B3	23.90
J3	23.90
Midwest	
N4	23.90
W8	24.15
I3	23.90
Wide Flange Carbon	
East	
B3	20.65
U1	22.75
J3	23.90
Midwest	
U1	22.75
N4	23.90
I3	23.90
Wide Flange	
High Strength Low Alloy	
East	
U1	24.30
Midwest	
U1	24.30

Strip

Hot Rolled Carbon	
Cut II Edged, all widths	
East	
U1	20.75
B3	20.75
J3	22.05
Midwest	
D1	22.05
I4	22.85
J3	22.05
W3	22.05
G2, G3	20.75
N4	22.55
W5	23.75
U1	20.75
A7	20.75
I3, B3	20.75

M2	22.05
S1	20.75
Cold Rolled Carbon Max. 75%	
East	
E4	29.75
S10	29.60
P15	24.80
R7	36.20
B4	36.60
G6	36.175
Midwest	
I4	38.30
W14	32.80
J4	34.05
S3	37.05

High Strength, Hot Rolled
Low Alloy, Cut Edge & Mill Edge
All widths (plus extras)

Midwest	
M2	22.05
W3	22.05
J3	22.05
G2, G3	20.75
S1	23.75
A7	25.35
High Strength, Cold Rolled	
Low Alloy, Mill Edge	
Midwest	
R7	44.65
S7	37.05
Alloy, Hot Rolled	
Midwest (plus extras)	
S1	26.10
I4	25.20
Alloy, Cold Rolled	
East (plus extras)	
E4 M6	43.35
B4	49.75
R7	42.95
P15	32.10
Midwest	
I4	44.30
S1	44.80

Sheets

Hot Rolled Carbon (18 Ga & heavier)	
East	
B3	20.75
J3	22.05
U1	20.75
Midwest	
M2, W3	22.05
D1	22.05
J3	22.05
G2, G3	20.75
I4	22.45
U1	20.75
S1, B3	20.75
I3	23.75
A7	23.75
W5	23.75
West	
U1	21.25
Cold Rolled, Class 1	
East	
B3/2	25.15
J3	26.15
U1	25.15
Midwest	
W3	26.15
M2	25.15
G2, G3	25.15
M11	25.15
J3	26.15
D1	26.15
U1	25.15
S1	25.15
B3	25.15
I3	26.15
A7	26.15
W5	26.15
West	
U1	25.65
Galvanized (hot dipped)	
East	
B3/2	27.30
U1	27.30
Midwest	
J3	28.00
D1	28.00
W3	28.00
Y1	28.00
G2, M11	27.30
U1	27.30
S1	30.30
W5	30.30

I3	30.30
A7	30.30
West	
U1	27.80
Enameling	
Midwest	
U1, S1	26.65
I3	29.65
A7	29.65
J3	27.65
Long Tenne	
Midwest	
W5	31.65
A7	31.65
U1	31.65

Tinplate

Electrolytic Tinplate	
Single Reduced (70 lb)	
East	per base box
J3	26.29
U1	30.12
Midwest	
U1	30.12
J3	26.29
M11	28.61
W3	26.29
W5	30.12
West	
U1	30.62
South	
U1	30.12
Double Reduced (55 lb)**	
Midwest	
M11	22.84
J3	21.49
U1	24.33
W3	21.49
W5	24.33
West	
U1	24.83
South	
U1	24.33
Black Plate	
Single Reduced (70 lb)**	
East	
B3	26.55
Midwest	
J3, W3	24.01
I3	24.57
W5	26.55
U1	26.55
M11	27.30
West	
U1	26.55
Double Reduced (55 lb)	
East	
B3	21.32
Midwest	
U1, M11	21.32
W5	21.32
W3, J3	18.93
West	
U1	21.32
South	
U1	21.32
**75 lb—base weight extra \$1.40	
**50 lb—base weight extra \$1.40	

Bars

Carbon Steel, Hot Rolled	
(Special quality)	
East	
R5	25.80
K3	25.80
J3	25.80
C10	27.05
B3	27.05
Midwest	
I4	26.00
I3	27.05
T10	25.80
C20, N4	25.80
K2	25.80
A7	20.25
West	
C6	24.45
South	
A8	20.65
Cold Finished Carbon	
East	
A11	22.15
T11, S8	31.00
J3/4, I2	31.00
M8, W10	31.00
N1	24.475

R4, B4	33.25
C10	31.00
Midwest	
W10	33.25
J3	31.00
B1	33.45
I2	30.75
N9	31.00
W14	22.20
B5, M9	34.75
South	
J3	31.95
Alloy, Hot Rolled	
East	
R5	27.95
K3	27.95
B3	29.20
C10	29.20
Midwest	
I3, C10	29.20
I4	27.35
A7	20.25
West	
C6	26.60
South	
A8	22.00
Alloy, Cold Drawn	
East	
I2	35.20
N1	37.90
R4	37.10
J3, W10, I2	34.85
T11, S8	34.85
C10	34.85
Midwest	
J3, W10, C10	34.85
B1	37.30
N9, I2	34.85
B5, M9	38.60
South	
J3	35.85

Plates

Carbon Steel	
East	
B3, U1	18.25
I4	18.25
P2	18.25
J3	26.75
Midwest	
B3, U1	18.25
I3	25.75
J3, A7	22.80
I4	25.75
S1	25.75
West	
U1	18.25
O2	23.00
South	
U1	18.25
Alloy East	
U1	28.55
P2, I4	33.55
J3	34.55
Midwest	
U1	28.55
I4	33.55
West	
O2	31.00
South	
U1	28.55

Wire

Carbon Steel	
East	
B3	27.10
A11	22.15
Midwest	
N4, W7	27.40
K2	24.20
South	
A8	22.85
West	
C6	24.95

Wire Rod

East	
B3/2	22.35
Midwest	
N4, K2	22.35
U1	24.10
A7	22.00
West	
C6	21.45
South	
G7	22.35

ORDERS CONTINUE TO SLIP AND SLIDE

November marked the third straight month of decline in new orders received by producers of durable goods. Orders in November totaled \$105.8 billion, down 0.6 pct from October.

But the November decline wasn't the only bad news on orders. After all, orders in October were down even more sharply as they tumbled 2.3 pct below September volume.

In all, as 1985 neared an end, orders were shaping up poorly. In November, orders were up only 1.3 pct from the year-ago period. That means, after allowing for inflation, there was a 3 pct to 4 pct decline in real dollars' order volume over the year-long period.

Moreover, as many executives in basic goods industries can testify, orders for their products were down more sharply than the overall trend line. Motor vehicles were the only basic goods showing any strength in orders through the first 11 months of 1985.

There were no special strengths or weaknesses along industry lines for orders in November. As U.S. Commerce Dept. analysts noted, "the decline...resulted from offsetting increases and decreases."

Transportation equipment was down \$1.9 billion, or 7.1 pct, to \$24.6 billion. In both October and November, declines in aircraft and shipbuilding more than offset gains in the motor vehicles industry.

Also down in November, were orders for primary metals. This decline was more than offset by increases in orders for machinery, both electrical and nonelectrical, and for fabricated metal products.

One of the very soft spots has been in orders for nondefense capital goods. In November, orders for these big-tag items were down 3.5 pct from September, and down 11.2 pct from February of last year.

Billions of Dollars, Seasonally adjusted
Monthly Total, unless otherwise noted
Source: U.S. Dept of Commerce

		Latest Month or Qtr	Previous Month or Qtr	Same Period Year Ago
CAPITAL EXPENDITURES (Annual Rates)				
U.S. Industry, Total	4th Qtr*	\$387.4	\$389.5	\$368.3
Manufacturing, Total	4th Qtr*	156.0	157.8	147.0
Manufacturing, Durable Goods	4th Qtr*	74.7	75.8	71.4
Mining Industry	4th Qtr*	15.8	16.3	17.0
KEY INDICATORS, Durable Goods Manufacturing				
New Orders	Nov.	104.2	104.5	104.4
Shipments	Nov.	107.1	106.5	102.4
Inventories	Nov.	190.1	190.5	190.7
Unfilled Orders	Nov.	351.6	354.5	348.1
NEW ORDERS, METALWORKING				
Capital Goods Producers, Nondefense Industries	Nov.	26.2	27.1	26.5
Capital Goods Producers Defense Industries	Nov.	7.0	6.2	10.1
Primary Metals, Total	Nov.	10.5	10.7	10.5
Steel (SIC 331)	Nov.	4.4	4.6	4.4
Iron & Steel Castings (SIC 332)	Nov.	1.4	1.2	1.1
Nonferrous Metals	Nov.	4.7	4.9	5.0
Nonelectrical Mach.-Equip. Industries, Total	Nov.	18.0	16.7	17.9
Engines & Turbines	Nov.	1.6	1.0	1.3
Farm Machinery & Equipment (Shipments)	Nov.	0.9	0.9	0.8
Construction, Mining & Mat. Hdlg. Equip	Nov.	3.0	2.8	2.7
General Industrial Machinery	Nov.	1.5	1.3	1.5
Fluid Power Equipment** (Index-1972=100)	Nov.	279.0	288.0	269.0
Metalworking Machinery	Nov.	0.8	0.9	0.9
Machine Tools, Total (\$Mill., Unadjusted)***	Nov.	186.2	229.9	212.0
Machine Tools, Metalcutting***	Nov.	171.6	156.0	160.0
Machine Tools, Metalforming***	Nov.	14.6	73.9	52.0
Electrical Mach. & Equip. Industries, Total	Nov.	16.3	15.8	15.0
Elec. Transmission Equip. & Ind. Apparatus	Nov.	2.3	2.2	2.0
Household Appliances	Nov.	1.5	1.5	1.4
Communication Equipment	Nov.	5.5	5.3	5.1
Transportation Equipment, Total	Nov.	24.6	26.5	28.5
Motor Vehicles & Parts (Shipments)	Nov.	18.1	17.6	17.4
Aircraft, Missiles & Parts	Nov.	6.4	7.9	9.7
Shipbuilding & Military Tanks	Nov.	-0.5	0.3	0.9
Fabricated Metal Products, Total	Nov.	15.1	14.8	13.1
Instruments, Total	Nov.	4.8	4.6	4.6

*Est. Commerce Dept. **Source: National Fluid Power Assn. ***Source: NMTBA